



XLS –Injector layout update



C. Vaccarezza

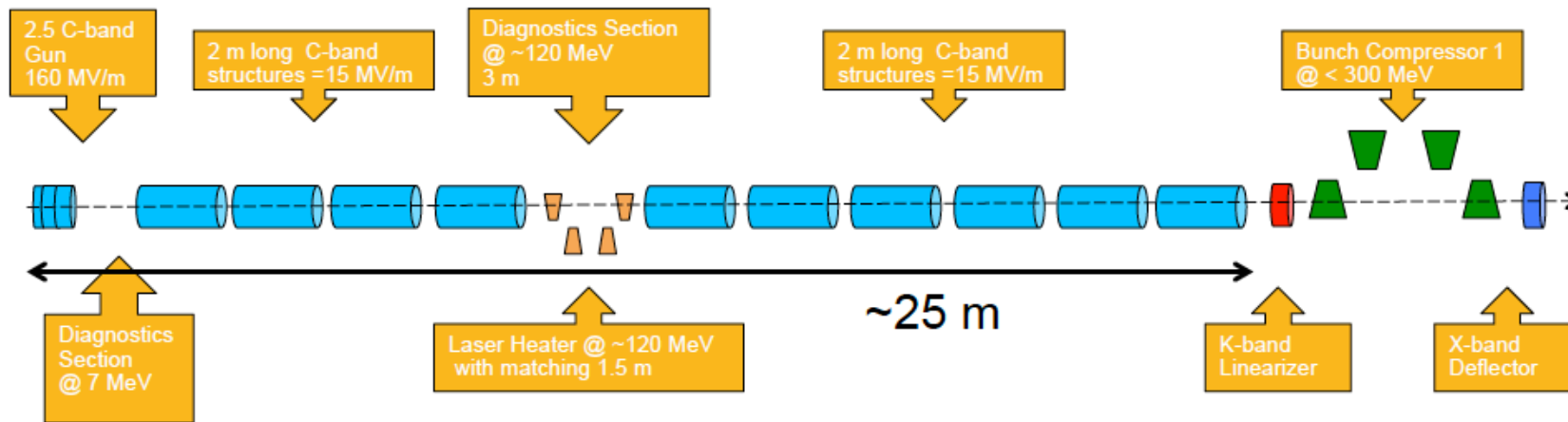


From Last meeting (Glasgow virtual)

- The energy of 300 MeV has been accepted as the BC1 entrance energy both at Low and High repetition rate, provided by 10 C-band sections at $E_{acc} = 15 \text{ MV/m}$.
- This study focuses on the replacement of the last 6 C-band sections with **8** X-band upstream BC1, even in this case at lower accelerating field i.e. $E_{acc} = 30 \text{ MV/m}$ to guarantee the operation at 1kHz rep rate
- NB the same consideration holds for the K-band sections, i.e. the applied field is considered at high repetition rate (feasible?)



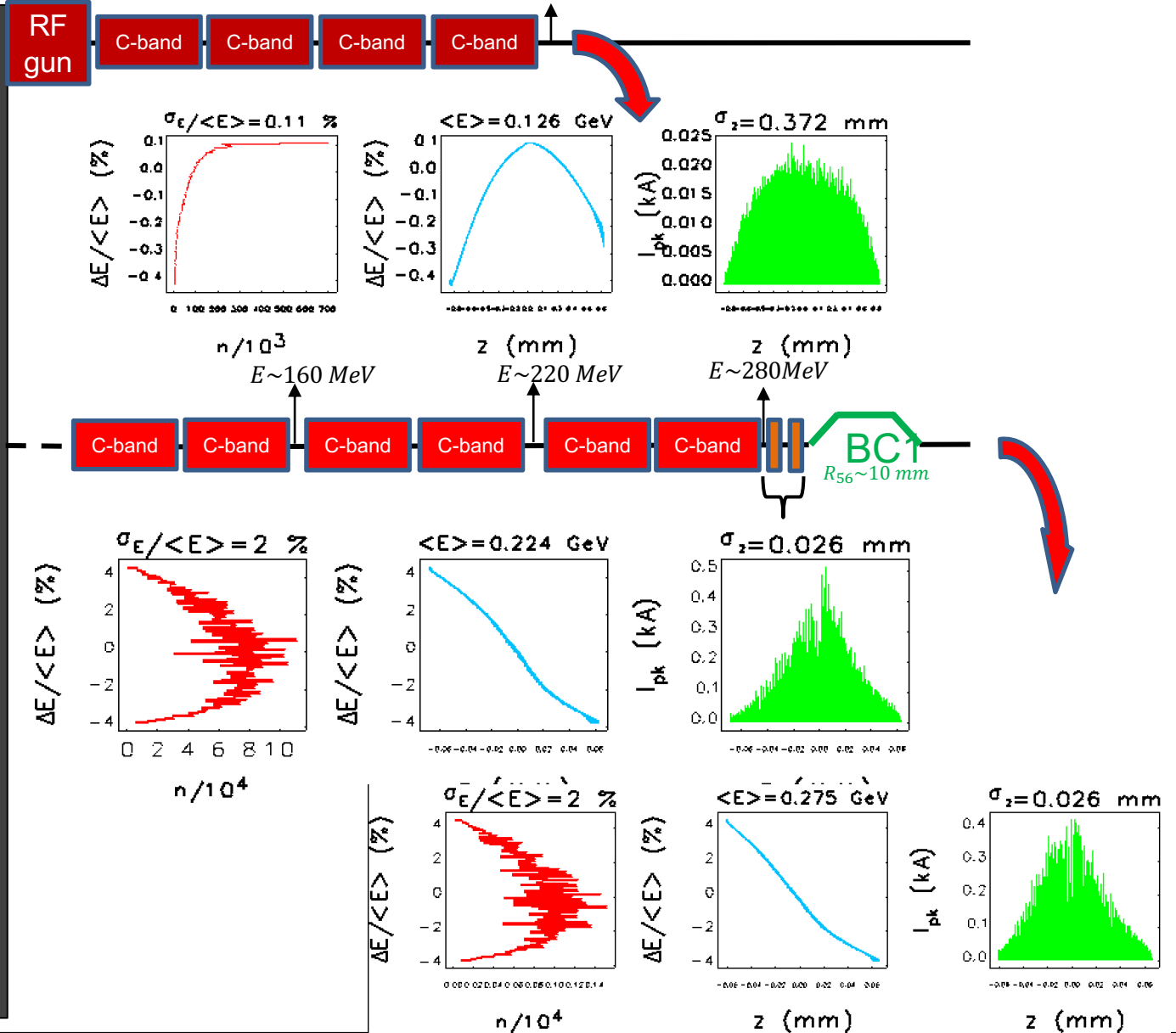
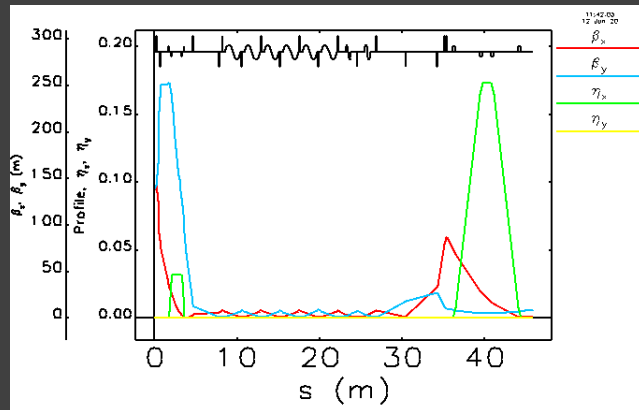
- One injector for all the operational modes (HRR and LRR)
 - 2.5 C-band gun with 160 MV/m cathode peak field => longer drift for diagnostics
 - Copper cathode and TiSa Laser
 - Same gradients 15 MV/m in the 2 m long C-band structures, max gain 30 MeV/structure
 - Same diagnostics positions (@ gun exit 7 MeV and in the drift parallel to the LH @ 120 MeV)
 - Same beam parameters at the linac exit
 - Matching with LH to be determined

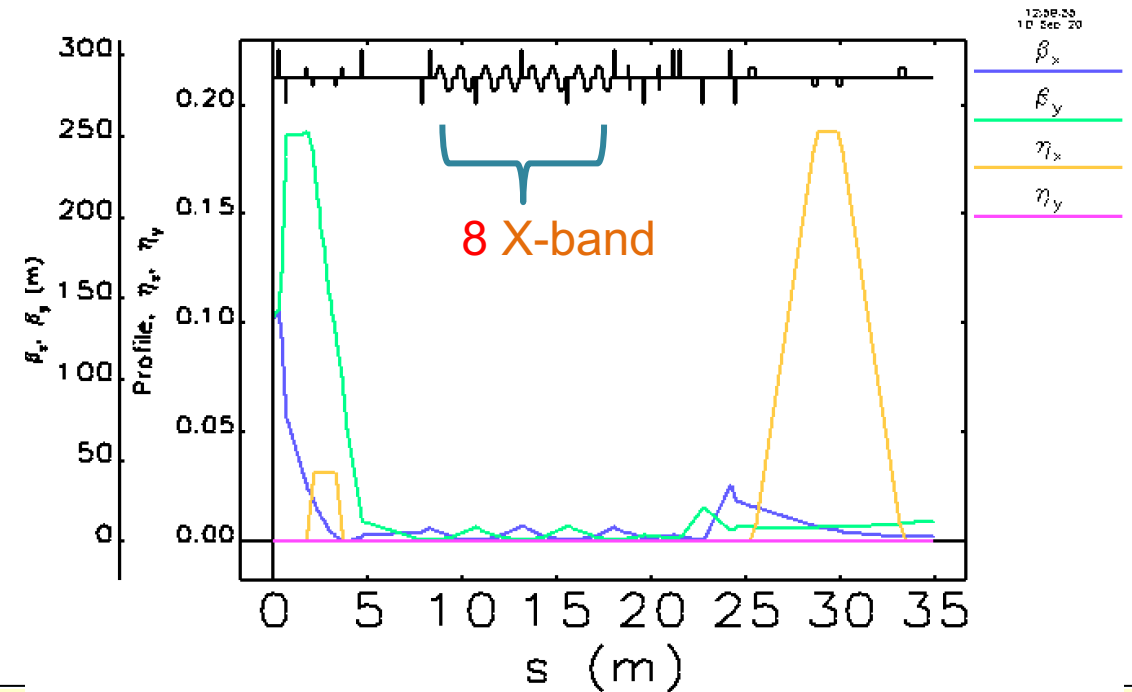
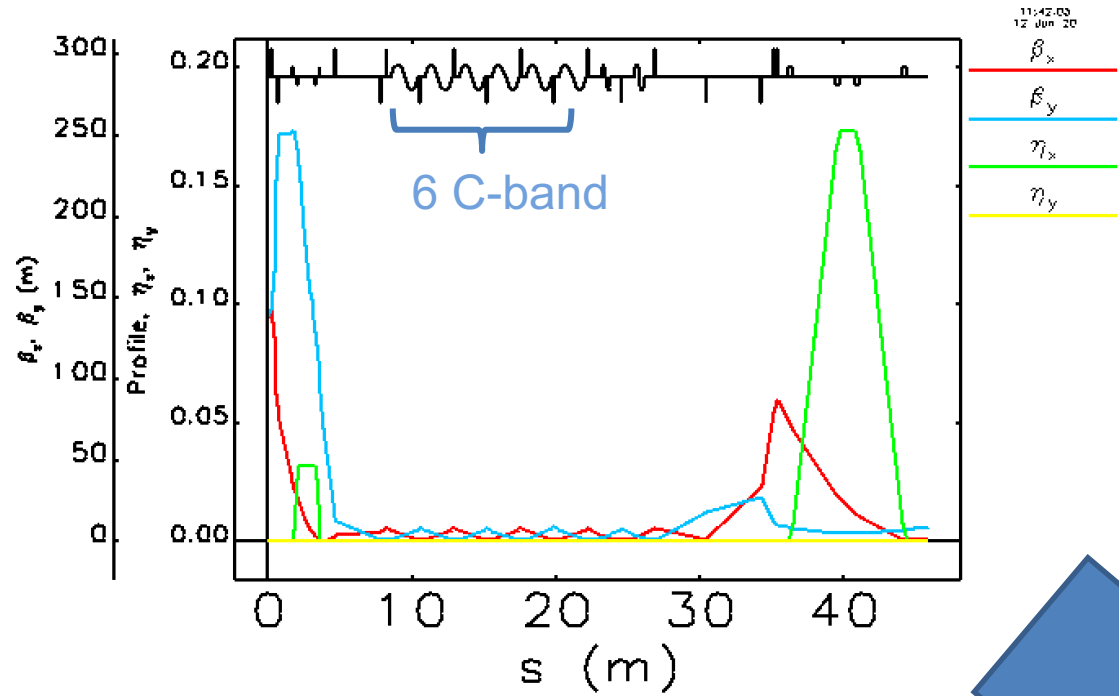


- Optimal BC1 input energy (=> and position) to be determined
 - Without Velocity Bunching
 - With Laser Heater less than 2 m long
 - K-band Linearizer just before the BC1, X-band RFD downstream BC1
 - Same beam parameters at the BC1 exit



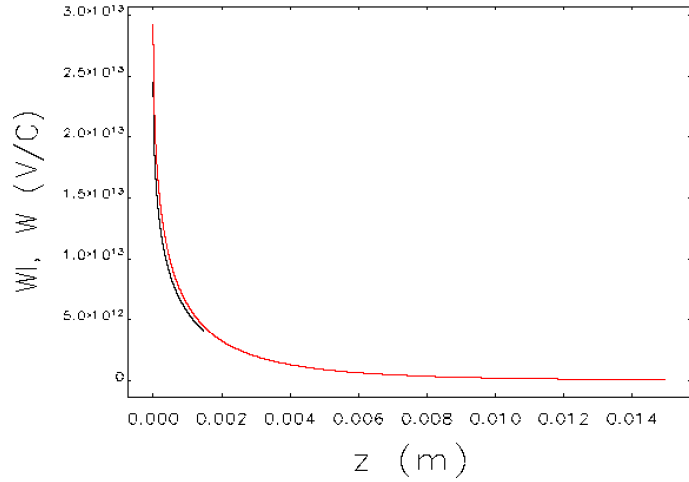
High rep rate oncrest beam from 2.6 cells PhInjector.



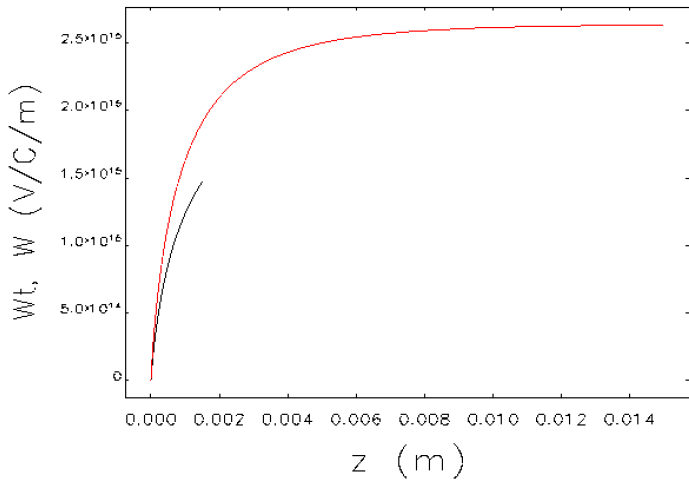




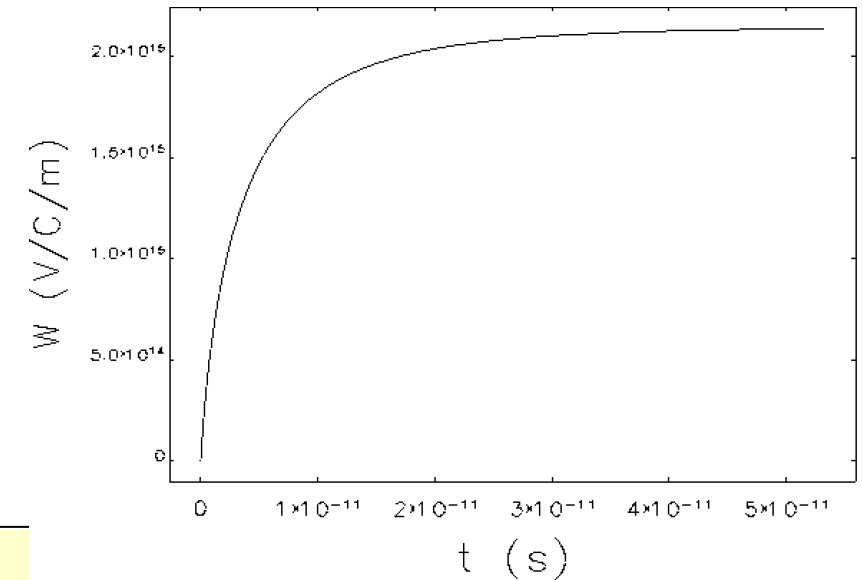
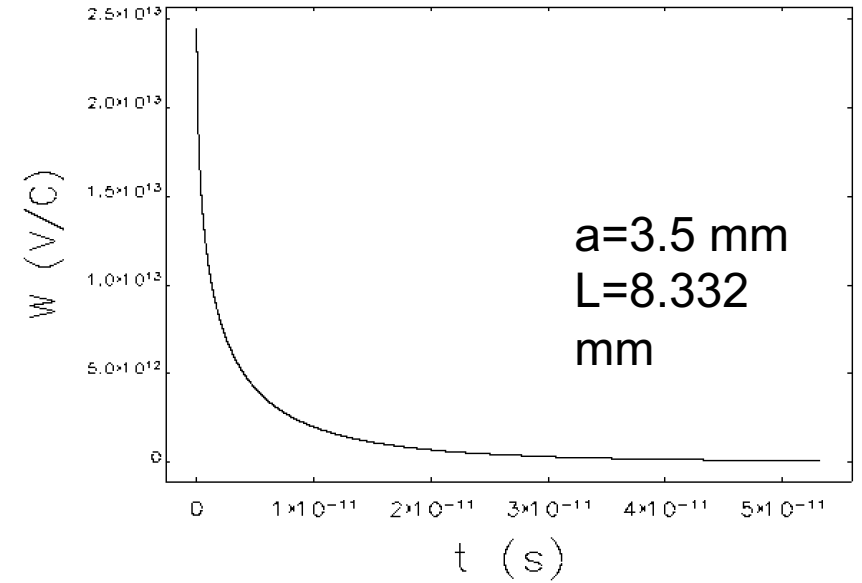
Usual check on calculated and applied wakes: X-band



From XLS repository

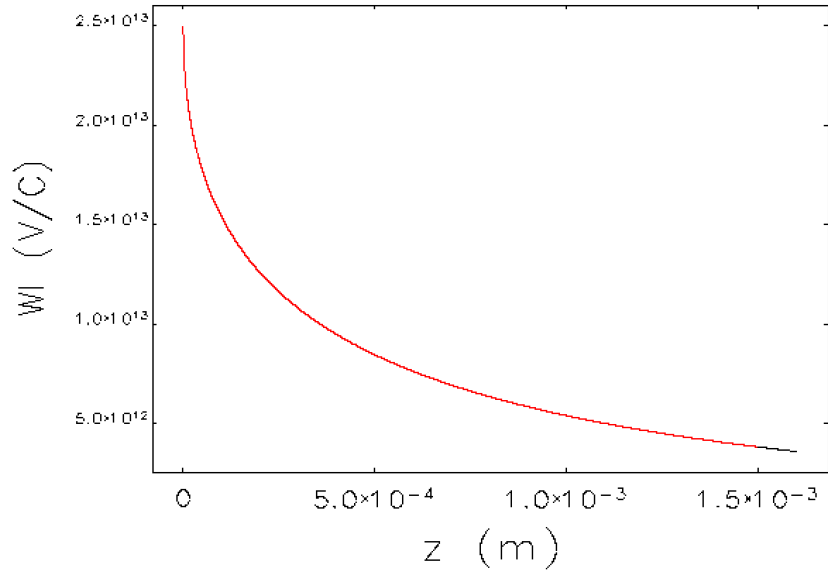


From K. Bane and reported parameters (M. Diomedede)

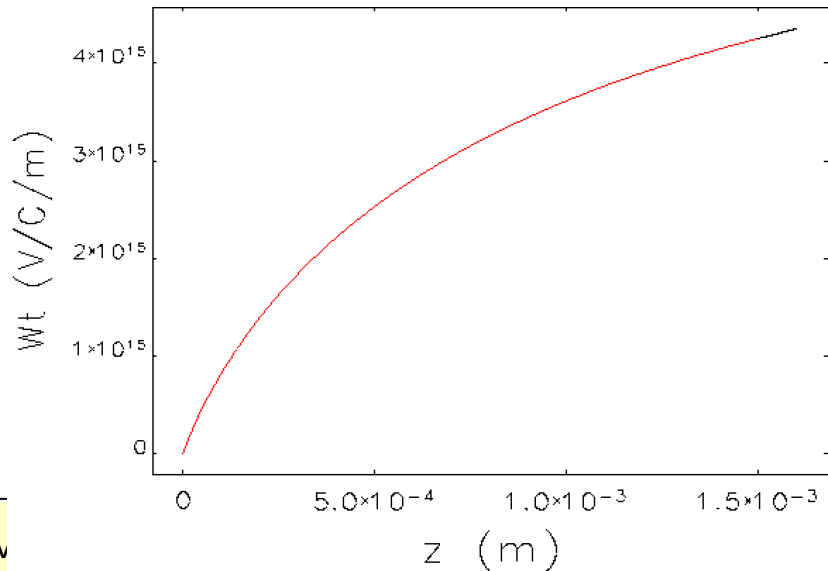




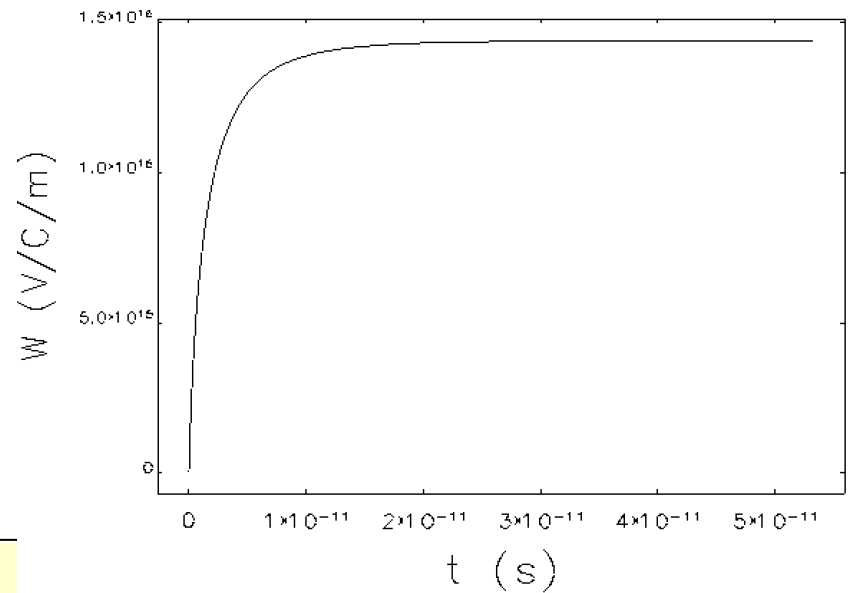
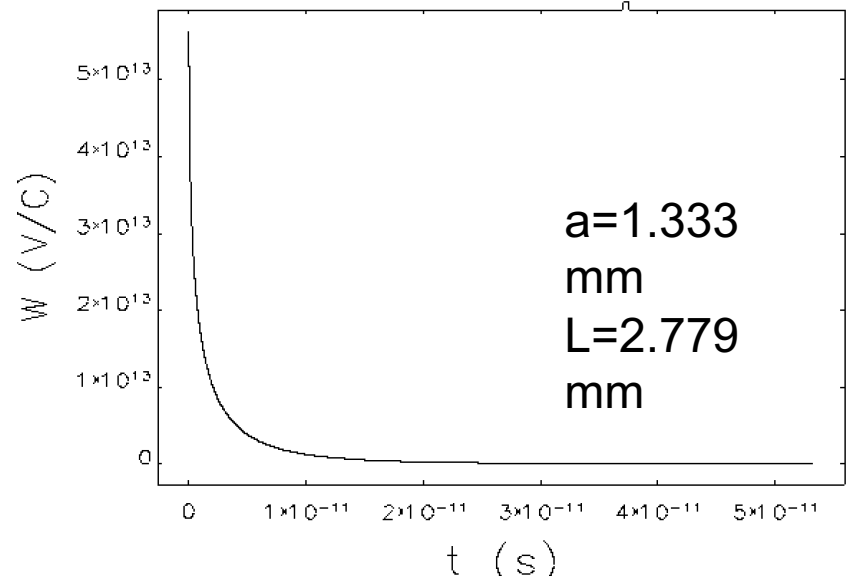
Usual check on calculated and applied wakes: K-band



From XLS repository y

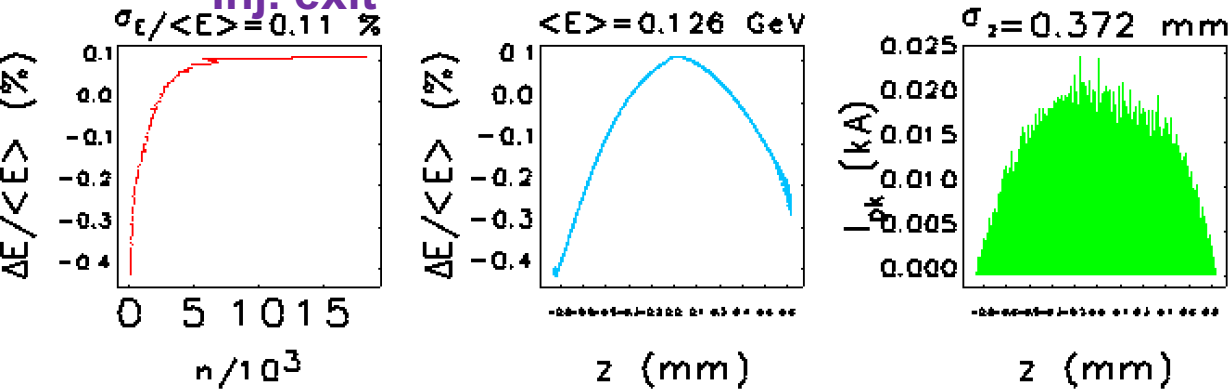


From K. Bane and reported parameters (B. Spataro)

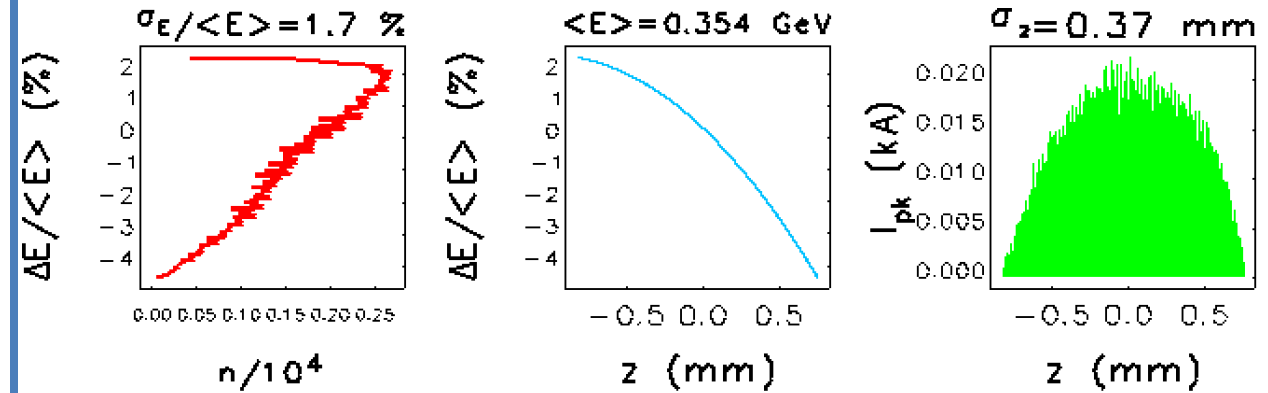




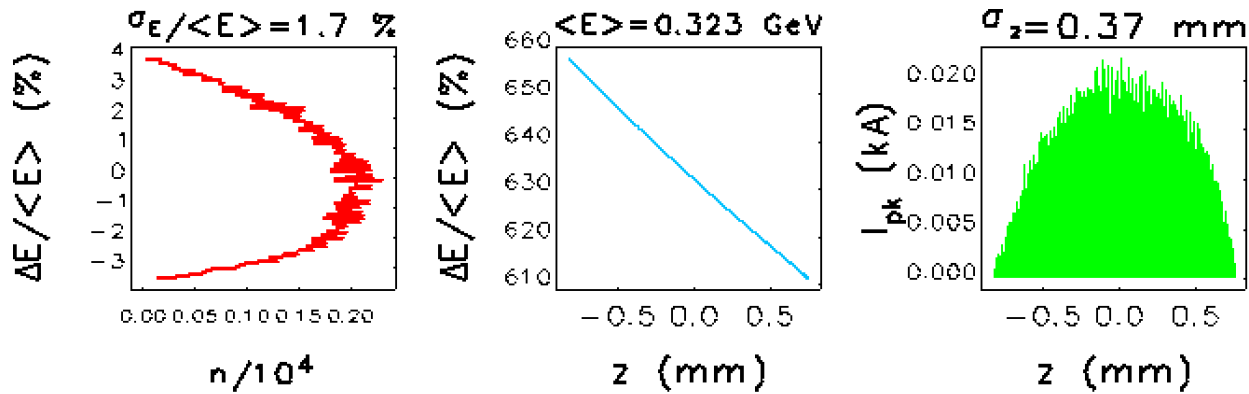
Low energy Ph-Inj. exit



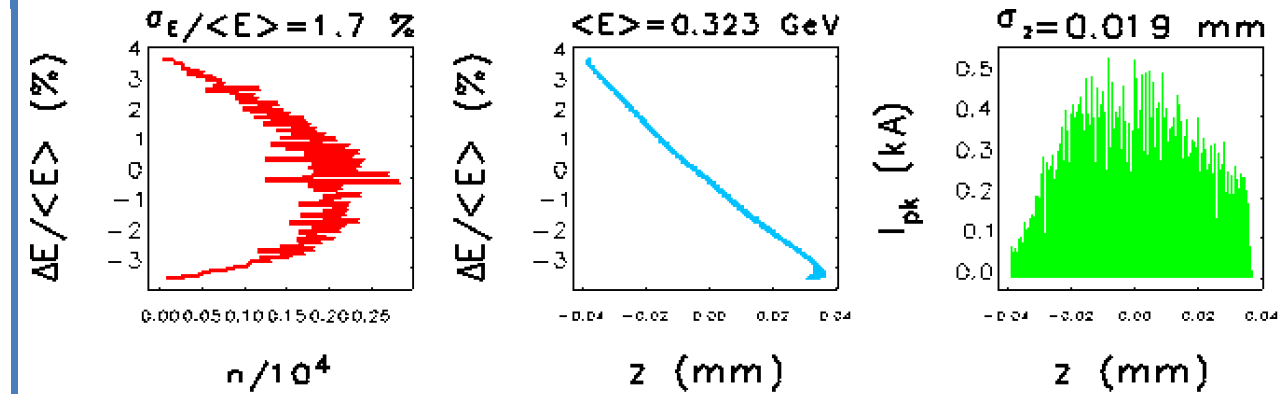
8th X-band exit



2nd K-band exit : 36 cells, L=10.004 cm, 16MV (integrated on each), $\phi = -92.5^\circ$

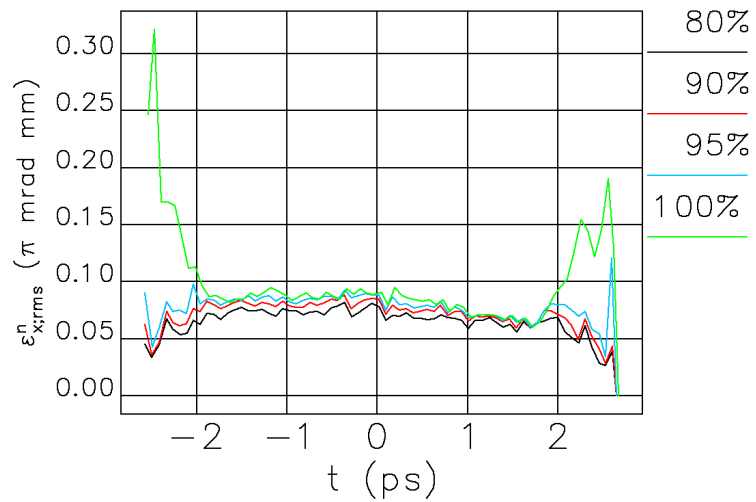
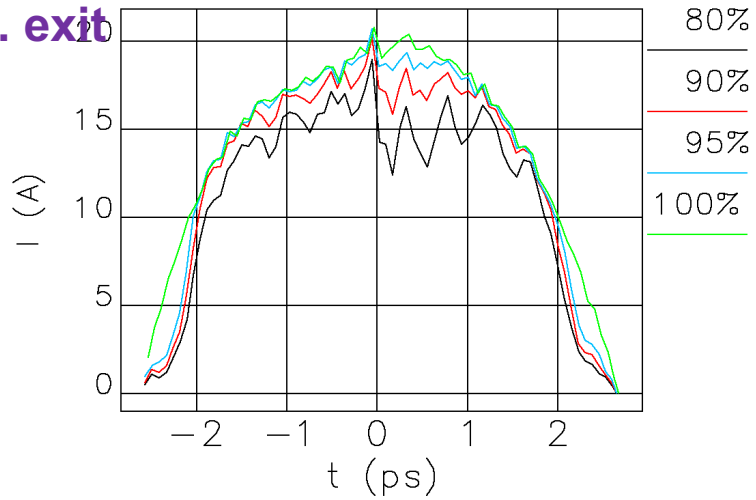


BC1 exit

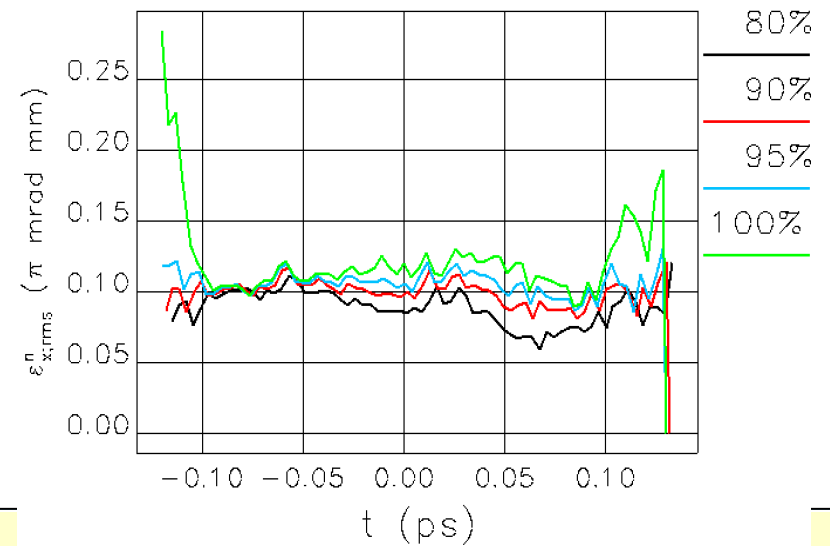
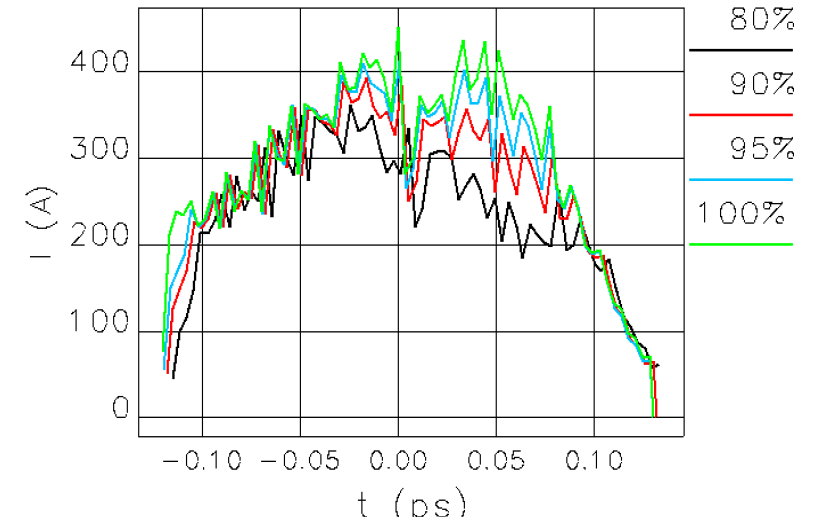




Low energy Ph-Inj. exit

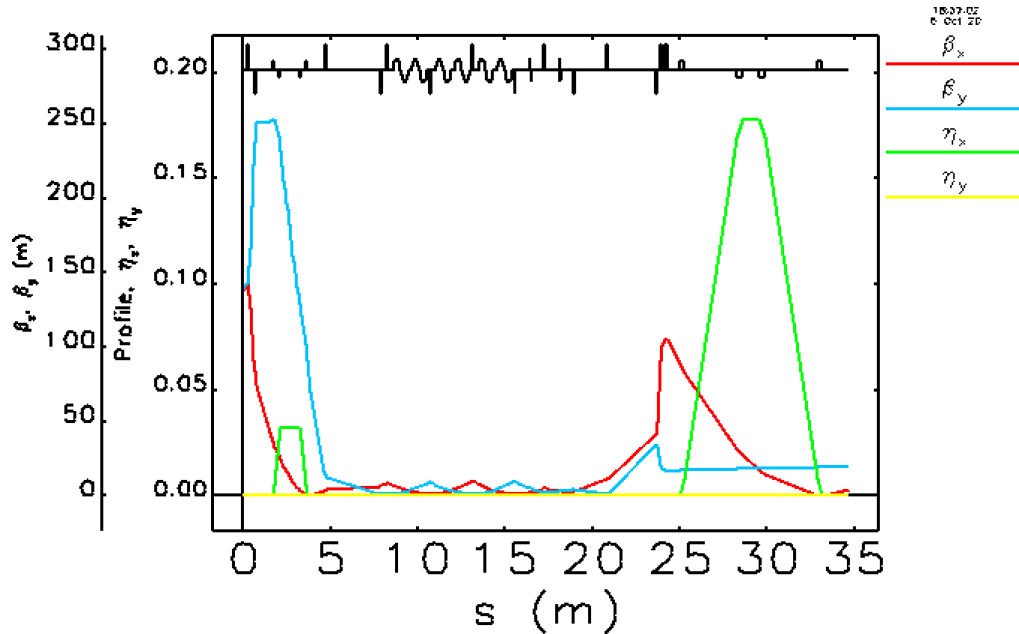


BC1 exit: $R_{56} = -20.6$ mm, $T_{566} = 31$ mm



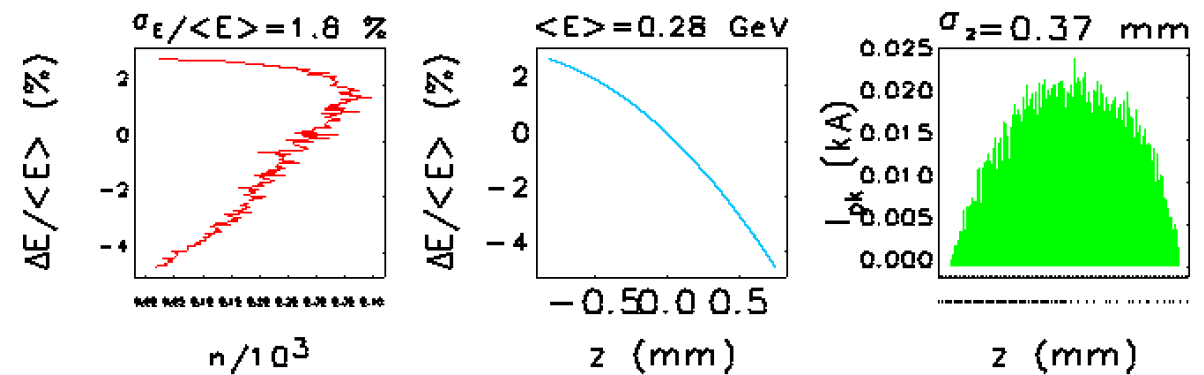


Further check with 6 X-band sections

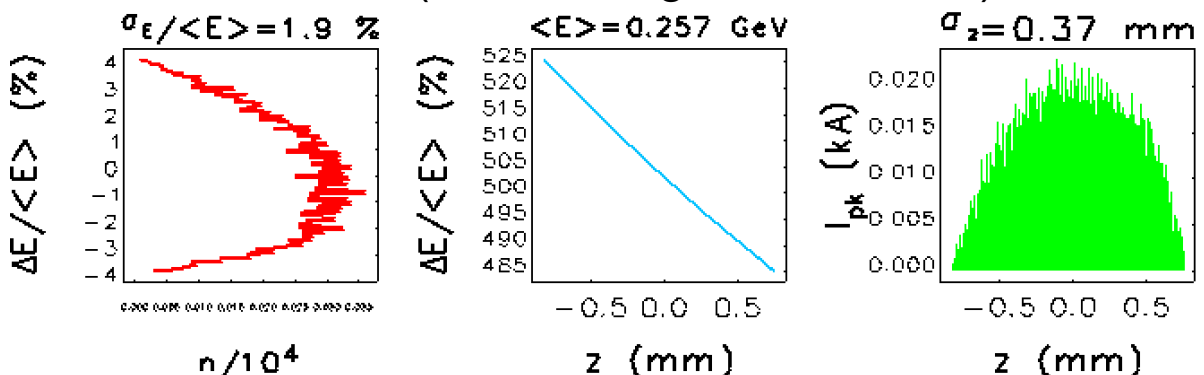


Twiss parameters for new_oncrest_check_CSR0N_300MeV_Xband_Hrep_slrcheck

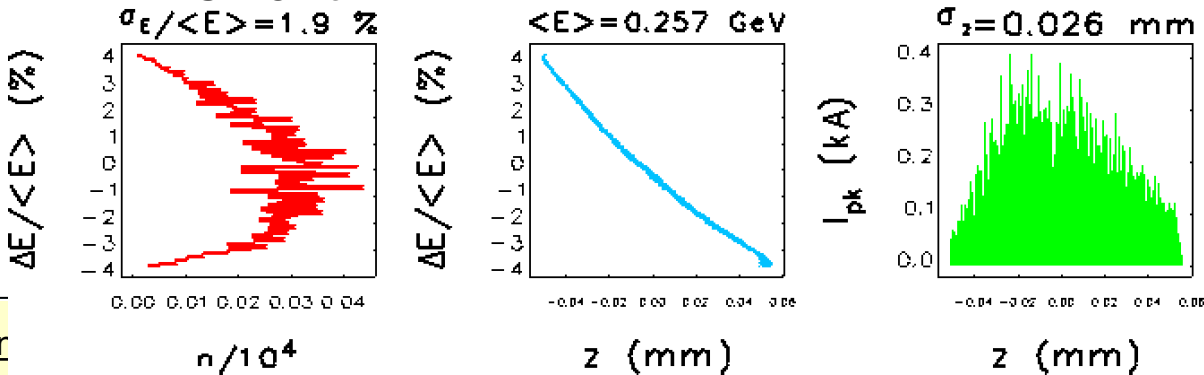
6 X-band exit



2 K-band exit (12 MV integrated on each), Phi=-92.5°



BC1 exit





| | | 6 C-band 15 MV/m (1 kHz) | 8 X-Band 32 MV/m (1 kHz) |
|-------------------------------------|----------------------------|--------------------------------|--------------------------------|
| Effective Accelerating Length | $L_{acc}^{eff} (m)$ | 11.4 | 7.2 |
| Current | $I(A)$ | 300 | 300 |
| Bunch length rms BC1 exit | $\sigma_z (\mu m)$ | 26 | 19 |
| Slice Hor Norm Emittance | $\varepsilon_{nx} (\mu m)$ | < 0.1 | ~ 0.1 |
| Energy before BC1 | $E(MeV)$ | 275 | 323 |

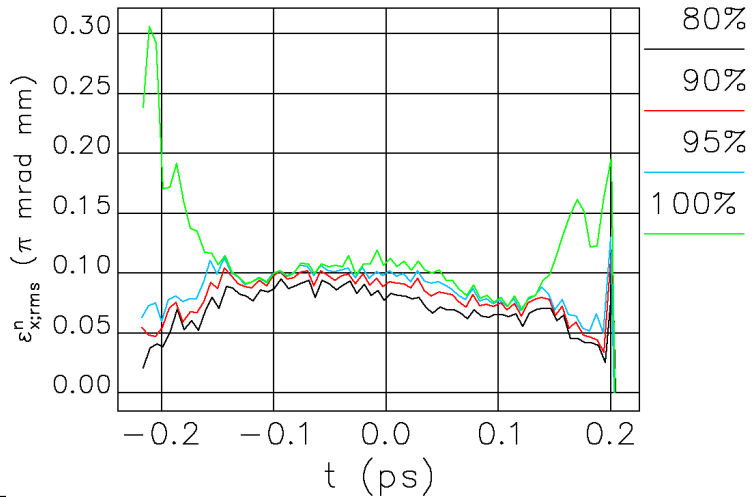
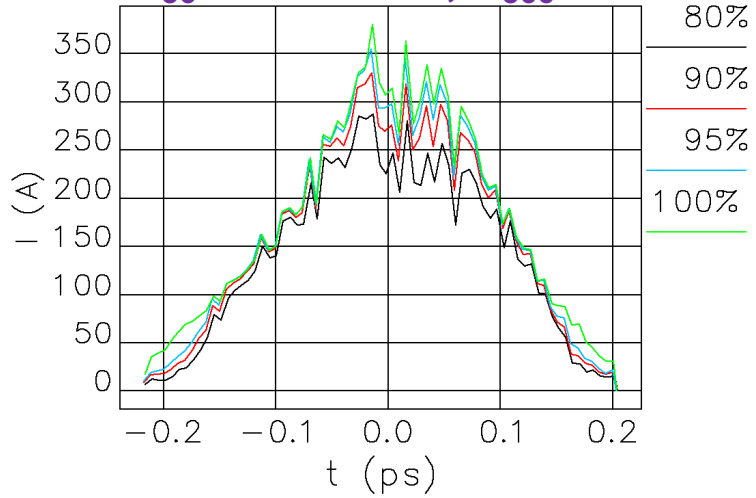


COMPARISON:

Not suitable for 300 MeV at High rep rate

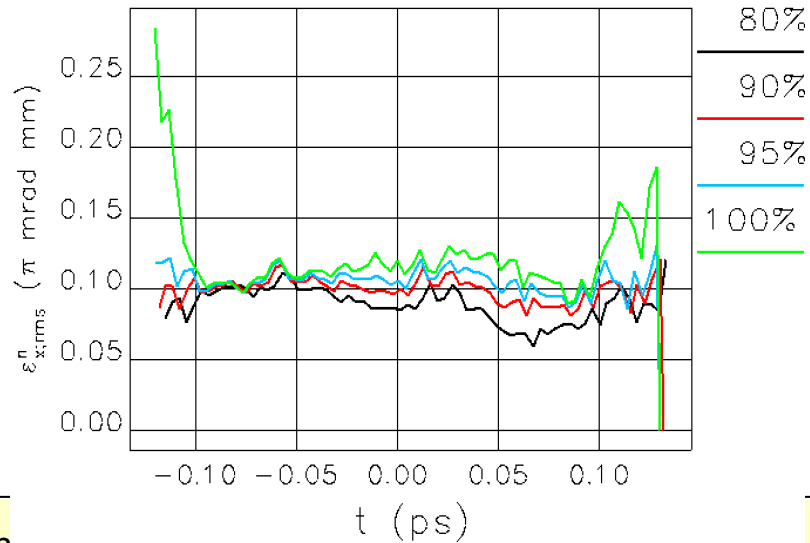
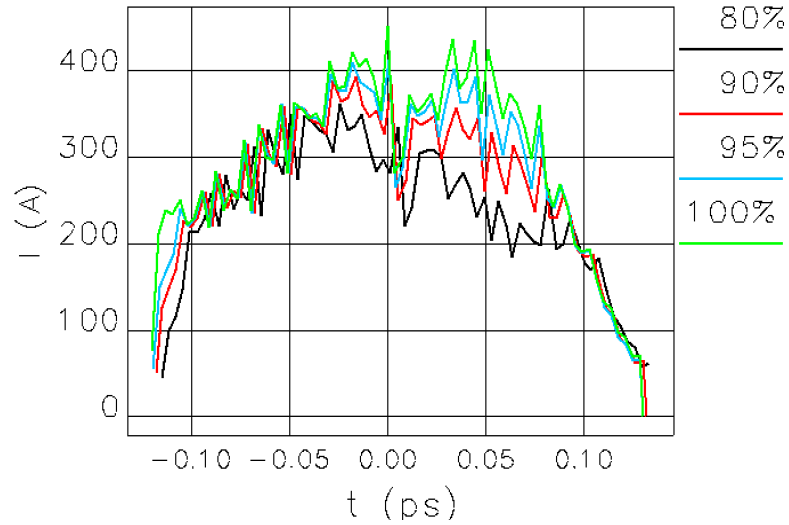
6 C-band - BC1 exit:

$R_{56} = -10.9$ mm, $T_{566} = 16$ mm



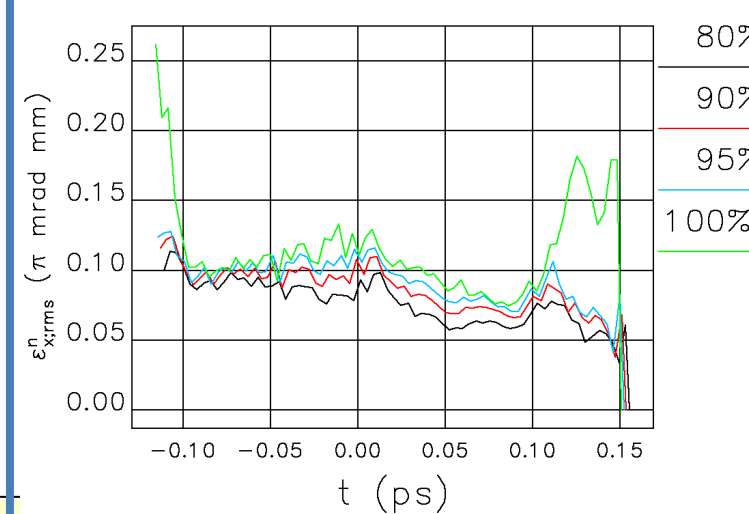
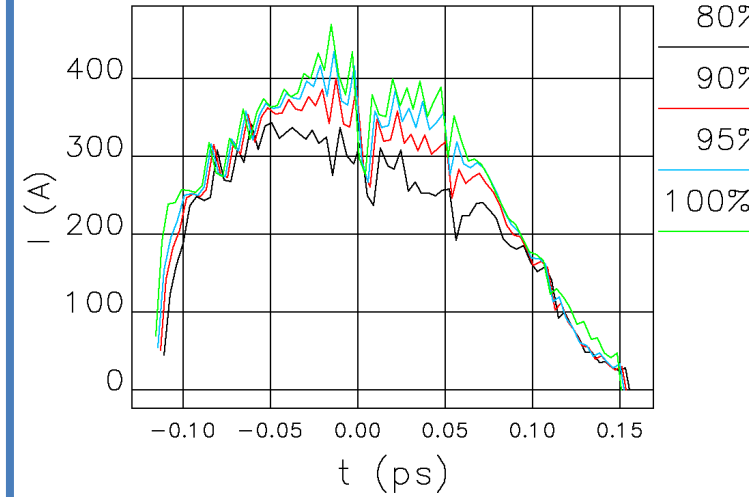
8 X-band - BC1 exit:

$R_{56} = -20.6$ mm, $T_{566} = 31$ mm



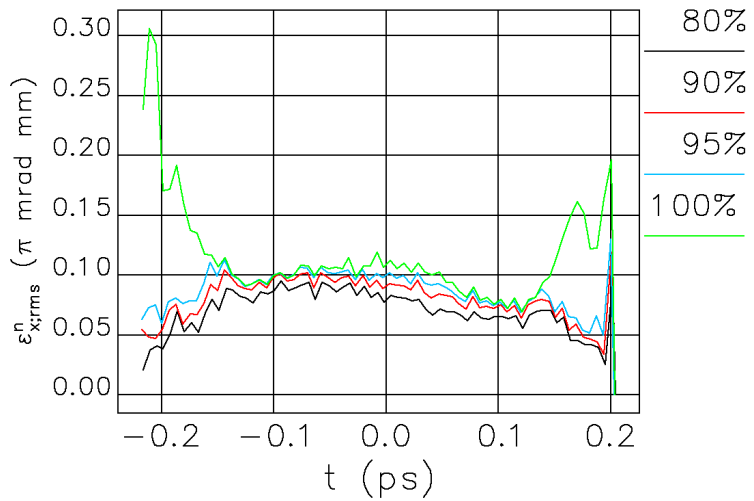
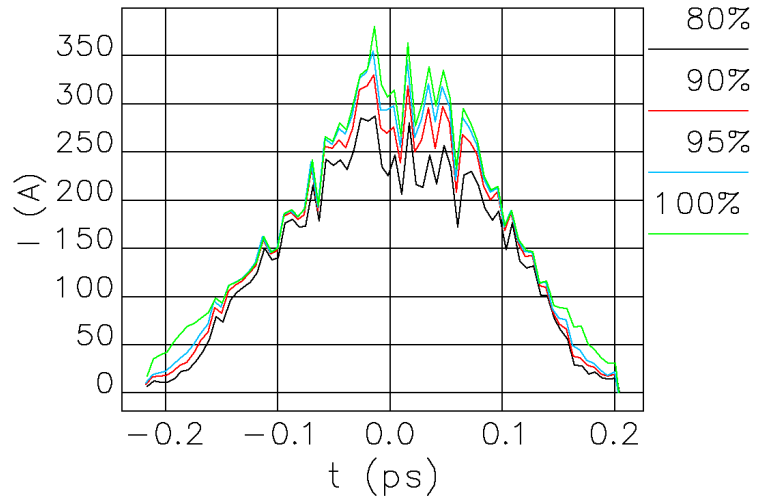
4 X-band - BC1 exit:

$R_{56} = -20.6$ mm, $T_{566} = 31$ mm

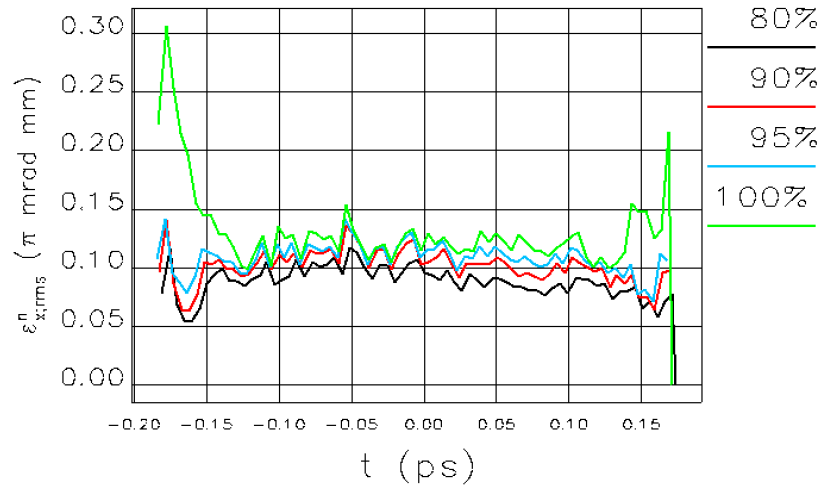
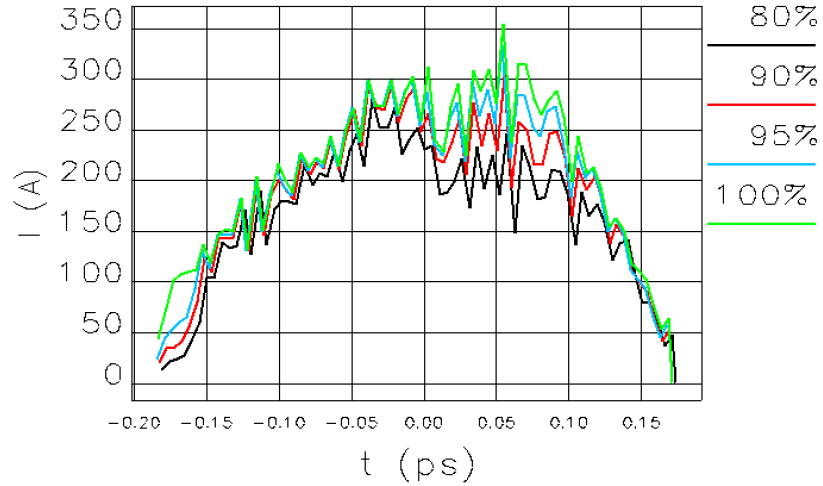




6 C-band - BC1 exit: $R_{56} = -10.9$ mm, $T_{566} = 16$ mm

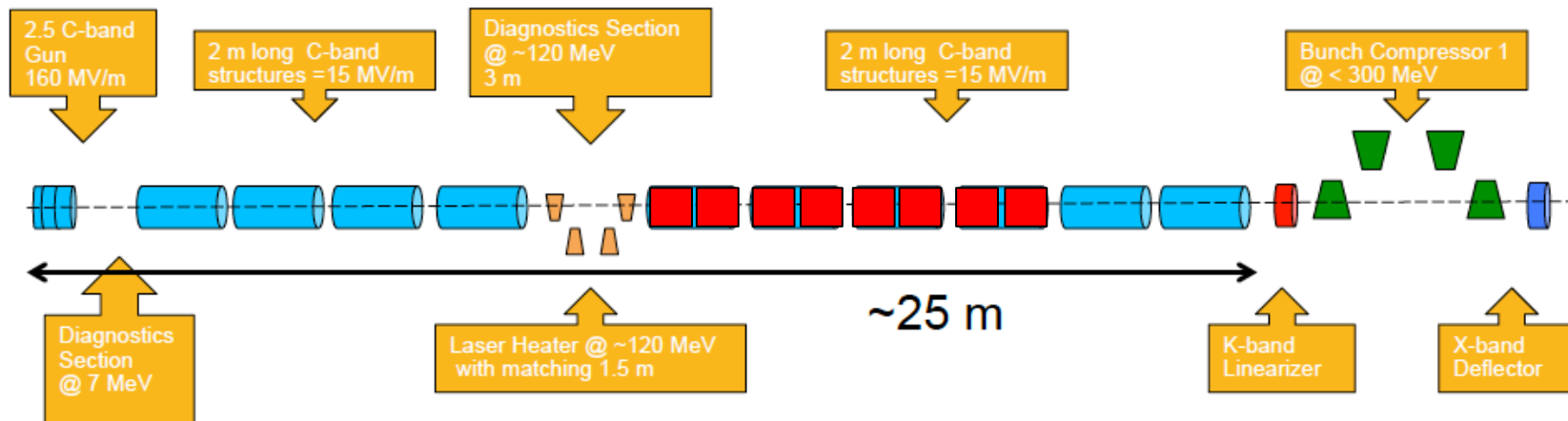


6X-band - BC1 exit: $R_{56} = -18.5$ mm, $T_{566} = 27$ mm





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Conclusions

- The replacement of 6 C-band sections with **8** X-band ones does not show obstacles from first simulations, even though the R_{56} is higher right now but this can be optimized in the next
- From the last XLS-Injector meeting held on Nov 2th 2020, a request came out to come back to the VB scheme in the Phoinjector now equipped with the 2.6 cells RF GUN. We foresee to finalize the PI-WP by the end of December 2020, provided the due simulation iterations with WP6.
- Furthermore the insertion of the adopted K-band structure will be done, according with the outcome of the last XLS-Linearizer Review meeting held on Nov 17th 2020
- Benchmark with also SC effect up to the BC1 exit to be done



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Thank you!

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